

REMARKS

This application has been carefully reviewed in light of the Office Action dated May 19, 2004. Claim 26 has been amended. Applicant reserves the right to pursue the original claims and other claims in this and other applications. Applicant respectfully requests reconsideration of the above-referenced application in light of the amendments and following remarks.

Claims 26-30, 32, 34, and 35 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Hamrah. The rejection is respectfully traversed.

Hamrah fails to anticipate the present invention. Hamrah does not disclose "a flowing plasma etchant mixture consisting essentially of at least one fluorocarbon and ammonia, wherein the flow rate ratio of each fluorocarbon to ammonia is from about 3:1 to about 40:1," as recited in claim 26 (emphasis added). The Office Action relies upon Hamrah's Example 3, pg. 6, lines 4-43 as disclosing the flow rates of fluorocarbon to ammonia.

Hamrah's etchant mixture consists of four different gases: CHF₃, Ar, CF₄, and NH₃ (Example 3, page 6, lines 4-43). Hamrah's etchant mixture does not consist essentially of at least one fluorocarbon and ammonia. Hamrah's etchant mixture includes Argon gas.

Moreover, Hamrah does not teach that the flow rate ratio of each fluorocarbon to ammonia is from about 3:1 to about 40:1. Hamrah's example 3 discloses nine flow rates for CF₄:NH₃: (1) 3 sccm:4 sccm (.75:1 ratio); (2) 3 sccm:4 sccm (.75:1 ratio); (3) 9 sccm:4 sccm (2.25:1 ratio); (4) 9 sccm:4 sccm (2.25:1 ratio); (5) 3 sccm:10 sccm (.3:1 ratio); (6) 3 sccm:10 sccm (.3:1 ratio); (7) 9 sccm:10 sccm (.9:1 ratio); (8) 9

sccm:10 sccm (.9:1 ratio); and (9) 6 sccm:7 sccm (.86:1 ratio) (Example 4, pg. 6, lines 4-43).

Hamrah does not teach that “the flow rate ratio of each fluorocarbon to ammonia is from about 3:1 to about 40:1,” as recited in claim 26 (emphasis added). Hamrah discloses a $\text{CF}_4:\text{NH}_3$ maximum flow rate of 2.25:1. This is well below Applicant’s claimed flow rate range of about 3:1 to about 40:1. Applicant’s claimed flow rate range is at least 33% greater than the maximum flow rate disclosed in Hamrah.

Still further, employing Applicant’s claimed plasma etchant mixture results in a conductive plug which adheres more effectively inside a contact opening (Applicant’s specification, pg. 12, lines 8-10). In addition, utilizing Applicant’s claimed plasma etchant mixture prevents erosion of side walls spacers which could materially detract from the performance of a conductive plug and gate stack (Applicant’s specification, pg. 12, lines 10-12).

Claims 27-30, 32, and 34-35 depend from claim 26 and are similarly allowable for at least the reasons provided above. Withdrawal of the rejection for claims 26-30, 32, 34, and 35 is respectfully solicited.

Hamrah also does not teach that the “flow rate ratio is within the range of from about 3:1 to about 20:1,” as recited in claim 34, or that the “flow ratio is within the range of from about 4:1 to about 10:1,” as recited in claim 35. These are additional reasons for the allowance of dependent claims 34 and 35.

Claim 31 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hamrah in view of Becker. The rejection is respectfully traversed.

For similar reasons provided above, Hamrah does not teach or suggest claim 26 from which claim 31 depends from. Hamrah does not disclose or suggest that “the flow rate ratio of each fluorocarbon to ammonia is from about 3:1 to about 40:1,” as recited in claim 26 (emphasis added). Hamrah discloses a $\text{CH}_4:\text{NH}_3$ maximum flow rate ratio of 2.25:1. Applicant’s claimed flow rate is at least 33% greater than Hamrah’s maximum disclosed flow rate. Becker is relied upon for disclosing an etchant composition consisting of CF_4 , CHF_3 and CH_2F_2 , and adds nothing to rectify the deficiencies associated with Hamrah.

Moreover, there is no motivation to combine the references. Becker discloses a chemical etchant composition consisting of CHF_3 , CF_4 , AR, and a CH_2F_2 additive material. The additive material is needed because “ CH_2F_2 is added to offset the disassociation properties of nitride as compared to oxide.” (Col. 2, lines 24-25). In other words, Becker’s etchant composition relies on the presence of a silicon nitride layer, i.e., an etch-stop layer. (Col. 6, lines 16-20). In Hamrah, by contrast, there is no silicon nitride layer. Accordingly, there is no motivation to combine the references since Hamrah does not disclose etching a silicon nitride layer. For at least these reasons, claim 31 should be allowable over Hamrah and Becker.

Claim 71 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hamrah. The rejection is respectfully traversed.

For similar reasons provided above, Hamrah does not disclose or suggest “a flowing plasma etchant mixture comprising at least CF_4 and NH_3 , wherein the flow rate ratio of $\text{CF}_4:\text{NH}_3$ is greater than about 3:1,” as recited in claim 71 (emphasis added).

Hamrah discloses a $\text{CH}_4:\text{NH}_3$ maximum flow rate ratio of 2.25:1. Applicant's claimed flow rate is at least 33% greater than Hamrah's maximum disclosed flow rate. The Office Action even acknowledges that Hamrah fails to specify the flow rate ratio of $\text{CF}_4:\text{NH}_3$ is greater than 3:1 (Office Action, pg. 6).

The Office Action alleges that it would have been obvious to employ any combination of flow-rate ratios of the etchant gases. Applicant respectfully submits that a *prima facie* case of obviousness has not been set forth. In the case where the claimed ranges overlap or lie inside ranges disclosed by the prior art, a *prima facie* case of obviousness exists. M.P.E.P. § 2144.05. This situation, however, is not present. Hamrah's maximum disclosed $\text{CF}_4:\text{NH}_3$ ratio of 2.25:1 does not overlap or lie within Applicant's claimed range of greater than about 3:1. Applicant's claimed flow rate range is 33% greater than Hamrah's. Accordingly, withdrawal of the rejection for claim 71 is respectfully solicited.

Applicant also respectfully submits that claim 72 was not rejected in the Office Action and is believed to be in immediate condition for allowance. The prior art of record does not teach or suggest "a flowing plasma etchant mixture comprising at least CHF_3 and ammonia, wherein the flow rate of said CHF_3 is from about 37 to about 42 sccm," as recited in claim 72. None of the Examples taught in Hamrah teach or suggest a flow rate for CHF_3 that is from about 37 to about 42 sccm.

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In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

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